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1. A flexible instrument, comprising.
- a flexible member having an intermediate portion and a distal tip;
at least one intermediate sensor disposed at a predetermined point along said intermediate portion of said member for providing an intermediate path signal indicative of the path of said intermediate portion of said flexible member; and
at least one distal sensor positioned proximate said distal tip of said flexible member for providing a distal tip position signal indicative of the position of said distal tip of said flexible member.

2. The flexible instrument of claim 1 wherein said flexible instrument is configured to sense a controlled magnetic field.

3. The flexible instrument of claim 2 wherein said controlled magnetic field is a three-dimensional magnetic field generated using a plurality of controlled magnetic coils.

4. The flexible instrument of claim 2 wherein said at least one distal sensor comprises a magnetic tip sensor for sensing said controlled magnetic field.

5. The flexible instrument of claim 4 wherein said magnetic tip sensor is an inductive coil that provides said distal tip position signal which is indicative of the three-dimensional positioning of said distal tip of said flexible instrument within said controlled magnetic field.

6. The flexible instrument of claim 2 wherein said at least one intermediate sensor comprises at least one magnetic intermediate sensor positioned along the length of said intermediate portion of said flexible instrument, where said at least one magnetic intermediate sensor senses said controlled magnetic field.

7. The flexible instrument of claim 6 wherein said at least one magnetic intermediate sensor is an inductive coil that provides said intermediate path signal which is indicative of the three-dimensional path of said intermediate portion of said flexible instrument within said controlled magnetic field.

8. The flexible instrument of claim 1 wherein said at least one intermediate sensor comprises at least one fiber-optic sensor positioned along the length of said intermediate portion of said flexible instrument, where ~~said at least one fiber-optic sensor provides said intermediate path signal which is indicative of the three-dimensional path of said intermediate portion of said flexible instrument.~~

9. The flexible instrument of claim 8 wherein said at least one fiber-optic sensor includes a fiber-optic flex sensor.

10. The flexible instrument of claim 8 wherein said at least one fiber-optic sensor includes a fiber-optic twist sensor.

11. The flexible instrument of claim 8 wherein said at least one fiber-optic sensor includes at least one optical fiber loop sensor having a light attenuation characteristic which varies in accordance with the path of said intermediate portion of said flexible instrument.

~~12.~~ The flexible instrument of claim ~~11~~ wherein said at least one optical fiber loop sensor includes a light source for generating a light signal which is transmitted through an optical fiber loop to a light sensor, where the attenuation of said light signal through said optical fiber loop is indicative of at least a portion of the three-dimensional path of said intermediate portion of said flexible instrument.

13. The flexible instrument of claim 1 further comprising a processor responsive to said intermediate path signal and said distal tip position signal for providing an indication, in a common reference frame, of the position and angular orientation of said distal tip and said intermediate portion of said flexible instrument.

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14. A flexible instrument, comprising:
- a flexible member having an intermediate portion and a distal tip;
 - at least one intermediate sensor disposed at a predetermined point along said intermediate portion of said member for providing an intermediate path signal indicative of the path of said intermediate portion of said flexible member;
 - at least one distal sensor positioned proximate said distal tip of said flexible member for providing a distal tip position signal indicative of the position of said distal tip of said flexible member; and
 - a processor responsive to said intermediate path signal and said distal tip position signal for providing an indication, in a common reference frame, of the position and angular orientation of said distal tip and said intermediate portion of said flexible instrument.

1 15. A flexible instrument system, comprising:
2 a flexible member having an intermediate portion and a distal tip;
3 at least one intermediate sensor disposed at a predetermined point along said
4 intermediate portion of said member, said intermediate sensor providing an
5 intermediate path signal indicative of the path of said intermediate portion of said
6 flexible member; and
7 a pair of elements, one of said pair of elements being an energy transmitter
8 and the other being an energy sensor, where one of said pair of elements is positioned
9 proximate said distal tip of said flexible member and the other said element is
10 positioned remotely, where the combination of said pair of elements provides a distal
11 tip position signal indicative of the position of said distal tip of said flexible member.

1 16. The flexible instrument system of claim 15 wherein said energy transmitter generates
2 a controlled magnetic field.

1 17. The flexible instrument system of claim 16 wherein said energy transmitter comprises
2 at least one magnetic coil.

1 18. The flexible instrument system of claim 17 wherein said energy sensor senses said
2 controlled magnetic field.

1 19. The flexible instrument system of claim 18 wherein said energy sensor comprises at
2 least one inductive coil.

1 20. The flexible instrument system of claim 17 wherein said energy transmitter is located
2 proximate said distal tip of said flexible member.

1 21. The flexible instrument system of claim 19 wherein said energy sensor is located
2 proximate said distal tip of said flexible member.

1 22. The flexible instrument system of claim 15 further comprising a processor responsive
2 to said intermediate path signal and said distal tip position signal for providing an indication,

- 3 in a common reference frame, of the position and angular orientation of said distal tip and
4 said intermediate portion of said flexible instrument.

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1 25. A method for determining the three-dimensional position of a flexible instrument
2 having an intermediate portion and a distal tip, comprising:
3 controlling a magnetic field proximate the flexible instrument;
4 generating an intermediate path signal indicative of the path of the
5 intermediate portion of the flexible instrument; and
6 generating a distal tip position signal indicative of the position of the distal tip
7 of the flexible instrument.

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1 20/26. The method of claim 25 further comprising processing the intermediate path signal
2 and the distal tip position signal to provide an indication, in a common reference frame, of
3 the position and angular orientation of the distal tip and the intermediate portion of the
4 flexible instrument.

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1 21/27. The method of claim 26 wherein generating a distal tip signal includes sensing the
2 magnetic field with a magnetic tip sensor positioned proximate the distal tip of the flexible
3 instrument.

1 28. The method of claim 26 wherein generating an intermediate path signal includes
2 sensing the magnetic field with at least one magnetic intermediate sensor positioned along
3 the length of the intermediate portion of the flexible instrument.

1 29. The method of claim 26 wherein generating an intermediate path signal includes
2 sensing the path of the intermediate portion with at least one fiber-optic sensor positioned
3 along the length of the intermediate portion of the flexible instrument.